PHYS 111
HOMEWORK #3

Due : 16 Sept. 2014

Remember to write on only one side of the paper. I will begin assessing penalties for homeworks not meeting the format specifications outlined in the syllabus.

1. Refer to problem 6 in the text, p. 61. Do parts a) and b). Then write a short paragraph describing (in prose) the trajectory defined by the graph. What is the average velocity for the trip? Five pts each part, 20 points for the entire question.

2. Your car' s brake system is such that you can come to rest from an initial velocity V in a distance X. If you start at initial velocity 2 V, how far would you travel before your brakes brought you to rest? Make sure your answer shows your procedure completely.

3. Problem 22 in text, p. 62.

4. Problem 40, text, p. 63.

5. This is often called the ' Monk and the Monastery' problem in mathematical logic. A monk leaves his office in a city one day exactly at noon and walks at a constant speed to the monastery on the outskirts of town which is a distance D from the city. Being a beautiful day, he walks slowly arriving at his destination at 7 pm. The next day, he leaves the monastery at exactly noon, and walks back to his office in the city (at a faster constant speed) along exactly the same path he took the day before. However, since the skies appear threatening, he walks rapidly, arriving at his office at 3 pm.

Will there be any point along the trip that he passes at the same time on the two days? Explain why or why not. (Drawing a graph of the two trips on the same set of axes might be very useful.) If there is such a point, determine how far from the city it is, and the time in which he reaches it on each day.

6. Consider a river with parallel banks that lie exactly on the x axis. A boat that can travel at a speed v in still water travels in a river of current V. The current is directed exactly along the - x axis. The boat travels a distance D downstream (in the direction of the current), stops, and returns to its starting point. Show that the time to complete the round trip is :

$$\text{time} = \frac{2\,v\,D}{v^2 - V^2}$$

assume that no time elapses when the boat is making its turn. What is the time to complete a round trip in the case where v = V? Provide a physical explanation for this result. (In discussion we will spend time delineating the difference between a physical and mathematical explanation.) (10 pts for

derivation, 5 pts for explanation)

7. A rock is dropped from rest from a cliff of height H above a well. After a time T elapses (from the moment when the rock is dropped), the sound of the rock splashing into the water is heard by an observer at the top of the cliff. If the speed of sound is c (and is a constant), derive an expression for the height of the cliff, H, in terms of T, c, and g (the acceleration due to gravity). We ignore the effects of air friction for this problem. If the speed of sound is 343 m/s and the splash is heard 9.37 s after the rock was dropped, determine the height of the cliff. (15 pts for derivation, 5 pts for calculation). Use g = 9.8 m/s/s